

529,401

Rec'd PCT/PTO 8 MAR 2005

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
8 April 2004 (08.04.2004)

PCT

(10) International Publication Number  
**WO 2004/028433 A2**

(51) International Patent Classification<sup>7</sup>: **A61H**

20910 (US). BIELAMOWICZ, Steven [US/US]; 1500 Twisting Tree Lane, McLean, VA 22101 (US).

(21) International Application Number:

PCT/US2003/030032

(74) Agent: GRANADOS, Patricia, D.; Heller Ehrman White & McCauliffe LLP, 1666 K Street, N.W., Suite 300, Washington, DC 20006-1228 (US).

(22) International Filing Date:

26 September 2003 (26.09.2003)

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(30) Priority Data:

60/413,773 27 September 2002 (27.09.2002) US

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

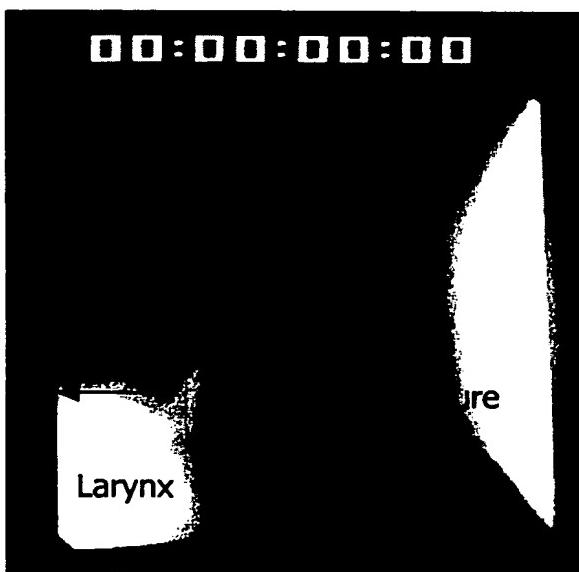
**Published:**

(75) Inventors/Applicants (for US only): LUDLOW, Christy, L. [US/US]; 8801 Garfield Street, Bethesda, MD 20817 (US). MANN, Eric [US/US]; 13712 Springdale Drive, Clarksville, MD 21029-1353 (US). BURNETT, Theresa [US/US]; 8324 16th Street, #324, Silver Spring, MD

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHODS AND DEVICES FOR INTRAMUSCULAR STIMULATION OF UPPER AIRWAY AND SWALLOWING MUSCLE GROUPS



(57) Abstract: Devices and methods were discovered that successfully provided patient autonomous control of both hyolaryngeal elevation, anterior hyoid motion and opening of the upper esophageal sphincter for swallowing by intramuscular stimulation of two muscles. The technology allows patient self stimulation of swallowing and can return oral feeding to dysphagia patients. Indwelling electrode stimulation of only two muscles generated as much as 80 % of normal synergistic movement leading to swallowing. The devices and methods also are useful for control of other upper respiratory muscle groups involved in speech and voice. Calibration techniques may be used in combination for greater freedom in setting and using electrodes over extended implantation time periods. These methods and devices can control complex movements of body solids such as bone and cartilage and tissues by electro stimulation of a minimum set of muscles simultaneously.